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ABSTRACT

The purpose of this study was to determine if answer sheet design, particularly a self-scoring answer sheet, was a differential variable of test anxiety. Data for the study was gathered from the administration of pre and post anxiety tests, given in conjunction with an in class psychology exam. Students in the control group used conventional IBM answer sheets, while students in the experimental group were furnished with self-scoring answer sheets. The following hypotheses were tested: (1) For the group of students using the IBM answer sheets, the pre-and posttest anxiety scores significantly differ from one another. (2) For the group of students using the self-scoring answer sheets, the pre-and posttest anxiety scores significantly differ. (3) For both groups the posttest anxiety scores significantly differ from one another. (4) For the two groups, the mean performance scores on the psychology exam significantly differ from one another. The results indicated that none of the hypotheses were confirmed. Therefore, it was concluded that answer sheet design has no significant influence on test anxiety. (Author/BW)

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TEST ANXIETY AS A DIFFERENTIAL FUNCTION OF ANSWER SHEET DESIGN

LEARNING THEORY

by

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NATIONAL INSTITUTE OF EDUCATION

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CONTENTS

		PAGE
I.	INTRODUCTION	1
II.	BACKGROUND AND SIGNIFICANCE	1
III.	BASIC ASSUMPTIONS	4
IV.	METHOD	5
V.	PROCEDURES FOR TREATING DATA	7
VI.	RESULTS	8
VII.	DISCUSSION AND SIGNIFICANCE	10
VIII.	RECOMMENDATIONS	13
IX.	SUMMARY	14
	REFERENCES	15
	APPENDIX	

LIST OF TABLES

TABLE		PAGE
I.	FREQUENCY DISTRIBUTIONS, MEANS AND STANDARD DEVIATIONS FOR THE PRE AND POST-TEST ANXIETY SCORES	8
II.	GAIN/LOSS ANXIETY SCORES BETWEEN PRE AND POST-TESTS FOR GROUP I AND GROUP II	9
III.	FREQUENCY DISTRIBUTIONS, MEANS AND STANDARD DEVIATIONS OF PSYCHOLOGY EXAM SCORES FOR GROUP I AND GROUP II	10

TEST ANXIETY AS A DIFFERENTIAL FUNCTION OF ANSWER SHEET DESIGN

I. INTRODUCTION

A psychologist once remarked that "Teachers don't like to give tests and students don't like to take them". Considered from the student's perspective, one probable significant factor contributing to this rather unfortunate state of affairs, is test anxiety, where "anxiety" is taken to refer to being in an achievement-related situation which proves fearful and from which there is no immediate escape. While numerous studies of the relationship between test anxiety and performance have been made, the overall purpose of the present study is to consider the source of test anxiety---answer sheet format?

II. BACKGROUND AND SIGNIFICANCE

With the requirements of academic grades, students are faced with the task of "passing" tests that attempt to measure what has been learned/taught. It might generally be agreed that students and their instructors would like to be assured that a student's test score is an accurate reflection of what was taught/learned, and not due to the interference of extraneous uncontrolled factors. Such factors as test anxiety as may be generated by the specific

characteristics of the answer sheet itself. To the extent that anxiety may be reflected in the student's test score, the test is no longer a single factor test, and its validity against a particular criterion becomes uncertain.

The subject of anxiety has received considerable attention as to its effects on learning and/or performance (1,2,3,4,5,6). However, there is significantly less information available as to the origins of test anxiety, particularly with regard to the activities characterized by the testing situation itself, e.g., test instructions, instructor, group atmosphere, test items, and answer sheet.

Generally, such research as it exists (7,3,8,9,10,11), has demonstrated no clear relationship among anxiety level, knowledge of results, and/or academic performance. At best, what has been shown is that each of these variables and their interrelationships should be given additional consideration. In one such study, McMahon (10) investigated the relationship between knowledge of results and test anxiety. He hypothesized that students receiving complete (versus partial or no knowledge) test results would have a lower level of test anxiety. Contrary to expectation, the hypothesis was not confirmed, indeed, the reverse proved true---knowledge of test results tended to increase test anxiety. In a related study involving test results and anxiety, Marso (11) investigated various testing procedures, i.e., grading or not grading exams, providing or not providing class feedback and discussion following the exams, to determine if any aforementioned procedures increased test performance of students with high-measured test anxiety. Results of the study

indicated that selected testing procedures did influence performance levels, but not in the predicted sense that less anxious testing conditions permitted students with high-measured anxiety to perform better---just the reverse.

In another study which dealt with the origins of test anxiety within the testing situation, McKeachie, et. al (5) proposed that during the course of a test, students are almost certain to encounter questions that are ambiguous or extremely difficult. It was reasoned that as students proceed with the test, anxiety is enhanced by these "failed" items (ambiguous, too difficult). And that such a state of increased anxiety may then interfere with the student's overall achievement score by reducing motivation or by producing frustration-instigated non-goal directed behaviors. Interestingly, McKeachie was able to reduce students' test anxiety by allowing them to make written comments on any multiple choice questions that they thought were ambiguous or too difficult. The result of such relieved anxiety was an improvement in test performance scores.

The present study will follow the lead of McKeachie as to the assumption that knowledge (suspected) of passed/failed (right/wrong) items may effect a student's anxiety state while taking the test. However, the matter of suspected knowledge of right and wrong will be changed to confirmed knowledge through the use of a self-scoring answer sheet. With a self-scoring answer sheet, a student receives immediate knowledge of right and wrong responses after each test item.

The development and use of self-scoring answer sheets (devices) as an alternative to the conventional multiple choice testing techniques has been widely reported on in the literature (12,13,14, 15,16 17). Indeed, the author of the present study has developed the ALLRIGHT ANSWER SHEET, which is a self-scoring answer sheet designed for use with classroom multiple choice tests. It is the ALLRIGHT ANSWER SHEET that will be used comparatively for the purpose of this study.

Evaluative studies of self-scoring answer sheets have dealt with a number of considerations, e.g., test performance, knowledge retention, scoring base. There is, however, no experimental evidence to show whether or not a self-scoring answer sheet contributes to a student's increased (or decreased) anxiety state during or at the conclusion of an actual testing situation. Therefore, the purpose of the present study is to determine whether or not test anxiety is a differential function of the design of the answer sheet. That is, where design involves a self-scoring immediate-knowledge-of-results answer sheet versus a more conventional maching-scored delayed-knowledge answer sheet. A secondary purpose of the study is to determine if answer sheet design effects classroom examination performance levels.

III. BASIC ASSUMPTIONS OF THE STUDY

The study was conducted and reported within the framework of the selected assumptions listed below:

(1) That the control and experimental groups are homogeneous

in that the population of subjects is normally distributed on the basis of age, GPA, motivational level, general anxiety levels, and the use of pharmacological drugs.

(2) That the size of the subject population is sufficient so as to permit limited generalizations of the findings beyond the specific population studied.

(3) That any difference that may exist between students' anxiety levels and the respective test conditions is attributable to the independent variable and not to extraneous uncontrolled variables.

IV. METHOD

Data for the study was gathered from all students enrolled in Introductory Psychology 151, Section 1, for Spring Quarter 1975, at Lorain County Community College (N=32).

Procedure. Students were randomized into two groups with 16 subjects in each group. Students in the control group (Group I) used the "conventional" IBM answer sheet H96221 (see Appendix). Students in the experimental group (Group II) were furnished with the self-scoring ALLRIGHT ANSWER SHEET. Immediately before the start of the examination, all students were asked to complete a pre-test of anxiety determination. As a student completed the academic psychology exam, he was requested to take a post-test of anxiety determination.

Instruments. The anxiety test used in the present study was

the "Self-Evaluation Questionnaire" (STAI FORM X-1), developed by Spielberger, Gorsuch and Lushene, and published by the Consulting Psychologists Press. The test is designed to measure a person's "at-this-moment" anxiety level and takes approximately four minutes to complete.

Since there is no published information available on the ALLRIGHT ANSWER SHEET, a brief description may serve to better understand its design function. The ALLRIGHT ANSWER SHEET is a student response system consisting of self-scoring printed answer sheets. Answers are masked by a cheat-proof concealing pattern of easily-removed latex-based ink dots. A marking device (stylus) is used to scrape (remove) the ink-masking dot so as to immediately reveal the right or wrong answer indicator (see Appendix).

The classroom exam is a multiple choice test normally given in introductory psychology.

Scoring Procedures. Both the pre-tests and post-tests of anxiety levels involved students answering twenty questions by degree-of-feeling indicators. A student's anxiety score is the total number of times he/she agreed with the "high" or "low" anxiety responses multiplied by the degree factors of 1,2,3, or 4.

For the ALLRIGHT ANSWER SHEET and the IBM H96221 answer sheet (Groups II and I respectively), a student's performance score was the total number of correct responses in one attempt.

V. PROCEDURES FOR TREATING DATA

Calculation Procedure. Calculations were made for mean anxiety-test scores on both the pre and post-tests for both Groups I and II. Also, calculations were made for mean performance scores for both groups on the psychology exam.

Index of Anxiety. In order to test for significant difference in the pre and post-test means of Group I and Group II, the "direct-difference" method of calculating t for matched pairs was used (18). For comparing the post-test means (anxiety test) and performance score means (psychology exam) between Groups I and II, a simple t-test for small samples was used.

Null Hypothesis 1: For Group I, the pre and post anxiety test scores do not significantly differ from one another.

Null Hypothesis 2: For Group II, the pre and post anxiety test scores do not significantly differ from one another.

Null Hypothesis 3: For Group I and II, the two sets of post-test anxiety scores do not significantly differ from one another.

Null Hypothesis 4: For Group I and II, the mean performance scores on the psychology exam do not significantly differ from one another.

Each of the above null hypotheses was accepted or rejected at the .05 level of significance.

VI. RESULTS

In order to determine if the two groups were drawn from the same population and therefore free of sampling bias, a t test was performed on the respective pre-test means for Group I and Group II. As Table 1 indicates, there is no significant difference between the sample groups regarding pre-test anxiety levels (t=1.71;NS).

Anxiety Scores.

Table 1 presents frequency distributions, means and standard deviations for students' pre and post-test anxiety scores both within and between Group I and Group II. As indicated, there are no clear differences within or between either group.

TABLE 1

FREQUENCY DISTRIBUTIONS, MEANS AND STANDARD DEVIATIONS FOR THE PRE AND POST-TEST ANXIETY SCORES

Anxiety Test Score Intervals	Frequency			
	Group I		Group II	
	Pre-Test	Post-Test	Pre-Test	Post-Test
66-69	0	0	1	1
62-65	1	0	2	1
58-61	1	1	1	1
54-57	1	0	1	0
50-53	1	1	3	1
46-49	1	5	1	2
42-45	2	4	1	4
38-41	1	1	2	3
34-37	3	1	3	0
30-33	3	1	1	2
26-29	1	0	0	1
22-25	1	1	0	0
18-21	0	1	0	0
N=	16	16	N= 16	16
$\bar{X}$=	40.94	41.56	$\bar{X}$= 48.13	44.50
σ=	11.58	9.56	σ= 11.38	10.47

$t_{\text{Pre-tests}} = 1.71$, df=30, NS.
$t_{\text{Post-tests}} = .83$, df=30, NS.

Null Hypothesis 1. For Group I, the pre and post-test anxiety scores do not significantly differ from one another. The application of a t test for matched groups resulted in the acceptance of the null hypothesis of no difference between means (t=.28;NS). Table 2 indicates that for the population of students studied, there was no significant increase or decrease in test anxiety as a consequence of using the IBM answer sheet.

Null Hypothesis 2. For Group II, the pre and post-test anxiety scores do not significantly differ from one another. The result of a t test for matched groups was not significant (t=.25;NS). As Table 2 shows, there was no significant increase or decrease in test anxiety for the group of students using the self-scoring ALLRIGHT answer sheet.

TABLE 2

GAIN/LOSS ANXIETY SCORES BETWEEN PRE AND POST-TESTS FOR GROUP I AND GROUP II

Group I		Group II	
Subjects	Gain/Loss	Subjects	Gain/Loss
1	+3	1	+24
2	-5	2	-11
3	+9	3	-10
4	-16	4	+1
5	-2	5	-42
6	-8	6	+7
7	+3	7	-25
8	-10	8	+4
9	-1	9	-9
10	+19	10	-16
11	-2	11	+14
12	-3	12	-2
13	-1	13	-14
14	+10	14	-2
15	0	15	+18
16	+14	16	+5
$\bar{X}_D$ = .63		$\bar{X}_D$ = 1.06	
σ_D = 8.71		σ_D =16.45	
$S_{\bar{X}_D}$ = 2.25		$S_{\bar{X}_D}$ = 4.25	

Group I t=.28, df=30, NS.
Group II t=.25, df=30, NS.

Null Hypothesis 3. For Groups I and II, the two sets of post-test anxiety scores do not significantly differ from one another. The results of a simple t test indicated no significant difference in post-test anxiety levels for students in the two groups (t=.83; NS) (see Table 1).

Null Hypothesis 4. For Groups I and II, the mean performance scores on the psychology exam do not significantly differ from one another. As Table 3 shows, for the population of students studied, exam scores were not significantly different, regardless of answer sheet design (t=.42; NS).

TABLE 3

FREQUENCY DISTRIBUTIONS, MEANS AND STANDARD DEVIATIONS OF PSYCHOLOGY EXAM SCORES FOR GROUP I AND GROUP II

Psychology Exam Scores	Frequency	
	Group I	Group II
28	0	2
27	1	3
26	2	0
25	3	2
24	2	1
23	2	2
22	2	2
21	1	1
20	2	1
19	0	1
18	1	0
17	0	1
N=	16	16
$\bar{X}$=	23.19	23.63
σ=	2.43	3.23

t=.42, df=30, NS

VII. DISCUSSION AND SIGNIFICANCE

In light of the lack of confirmation of any of the four stated hypotheses, it is suggested that answer sheet design is of little

or no consequence in effecting test anxiety. Several interpretations of these findings can be offered. One, such results tend to be at variance with the earlier mentioned McMahon study in which it was hypothesized that knowledge of results would lower test anxiety. While McMahon actually found the reverse true, the present investigation concluded that knowledge of results (self-scoring answer sheet) had essentially no effect either on reducing or increasing test anxiety. Two, the results of the present study also tend to differ from the McKeachie study. It will be recalled that McKeachie, et. al. proposed that during the course of the exam, students invariably encountered test items that they "fail", and that such failures increase a student's test anxiety. The increased test anxiety may then interfere with a student's performance score. In the present study, students also encountered "failed" items (self-scoring answer sheet), yet no corresponding increase in test anxiety was detected. This latter point held true regardless of whether one compared pre and post-test anxiety levels with the same answer sheet, or whether one compared the two groups on post-test anxiety levels. Without an increase in test anxiety, it may therefore be assumed that performance scores on the psychology exam were likewise uneffected. Indeed, this was the case, there was no significant difference between the two groups as to exam performance scores.

The question of why the present study's results were at variance with the two aforementioned studies may be considered from two perspectives. One, the necessarily small sample sizes may have

unduly mitigated against a valid evaluation of the variable under investigation. Originally, there were to be two groups of 20 students each, however, due to the exigencies of time, a total of eight students were "lost" over the span of the 10-week term. Whether this "loss" would have made a real difference can only be speculated about. Two, the relative shortness (30 items) of the psychology exam may have been such that potential test anxiety never had a chance to accumulate to the point of detectability. A third factor to be considered as a possible influence on the study has to do with the anxiety-test instrument itself. The "Self-Evaluation Questionnaire' consists of two forms; a measure of general and at-this-moment anxiety states. While the reliability figures are fairly high for Form X-2, the reliability figures for Form X-1 are suspiciously low (.48 for a 2-day test re-test situation). An anxiety instrument with higher reliability would certainly have been a more desirable choice for the study, particularly in light of the extremely short time-lapse (approximately 35 minutes) between the occurrence of the pre and post-anxiety tests.

Overall and in light of the above discussion, it would appear that, as far as determining whether or not answer sheet design is a factor influencing test anxiety, the question has still not been answered satisfactorily. While additional research is strongly indicated, it may tentatively be assumed that the author's original guess about the self-scoring answer sheet increasing test anxiety was not confirmed. While not assuredly denied, the indication is that until demonstrated evidence to the contrary, the self-scoring ALLRIGHT ANSWER SHEET will continue to be used at Lorain County

Community College.

VIII. RECOMMENDATIONS

The following recommendations seem appropriate, as derived from the findings of the present study.

That the use of self-scoring answer sheets be encouraged, at least from the standpoint that they do not increase test anxiety, as previously thought. Such encouragement is of particular importance at Lorain County Community College as the ALLRIGHT ANSWER SHEET is presently used by a number of instructors.

That students, who might (and have) initially express hesitancy as to the use of self-scoring answer sheets because of the assumed build-up of anxiety resulting from immediate knowledge of results (wrong answers), be informed that such fears are generally unfounded. Indeed, the mere mention that an empirical study on the matter has been done is likely to have a "calming" effect.

That the present study, given the dearth of research in this area and the necessarily small sample size, be considered a pilot investigation. Additional research with the ALLRIGHT ANSWER SHEET is strongly recommended. Any replication of the present study might take into consideration the following suggestions: (1) That a different anxiety-test instrument be considered, possibly the Test Anxiety Questionnaire (TAQ) by Mandler and Sarason, 1952, (2) That a more lengthy exam be used, possibly 50-60 test items, and (3) That the sample size be increased.

IX. SUMMARY

The purpose of this study was to determine if answer sheet design, particularly a self-scoring answer sheet, was a differential variable of test anxiety. Data for the study was gathered from the administration of pre and post anxiety tests, given in conjunction with an in-class psychology multiple choice exam. Students in the control group used conventional IBM answer sheets, while students in the experimental group were furnished with self-scoring answer sheets.

The following four hypotheses were tested: (1) For the group of students using the conventional IBM answer sheets, the pre and post-test anxiety scores significantly differ from one another, (2) For the group of students using the self-scoring answer sheets, the pre and post-test anxiety scores significantly differ from one another, (3) For both groups the post-test anxiety scores significantly differ from one another, and (4) For the two groups, the mean performance scores on the psychology exam significantly differ from one another.

The results of the study indicate that none of the four hypotheses was confirmed. And therefore, it was concluded that answer sheet design (self-scoring) had no significant effect on test anxiety.

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APPENDIX

A-IBM Answer Sheet H96221

B-ALLRIGHT ANSWER SHEET

APPENDIX A

NAME _____

COURSE _____

DATA CODE _____

INSTRUCTOR _____

IDENTIFICATION NUMBER

	0	1	2	3	4	5	6	7	8	9
	0	1	2	3	4	5	6	7	8	9
	0	1	2	3	4	5	6	7	8	9
	0	1	2	3	4	5	6	7	8	9
	0	1	2	3	4	5	6	7	8	9
	0	1	2	3	4	5	6	7	8	9
	0	1	2	3	4	5	6	7	8	9
	0	1	2	3	4	5	6	7	8	9
	0	1	2	3	4	5	6	7	8	9
	0	1	2	3	4	5	6	7	8	9

	T	F			
1	1	2	3	4	5
3	1	2	3	4	5
5	1	2	3	4	5
7	1	2	3	4	5
9	1	2	3	4	5
11	1	2	3	4	5
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61	1	2	3	4	5
63	1	2	3	4	5
65	1	2	3	4	5
67	1	2	3	4	5
69	1	2	3	4	5

	T	F			
2	1	2	3	4	5
4	1	2	3	4	5
6	1	2	3	4	5
8	1	2	3	4	5
10	1	2	3	4	5
12	1	2	3	4	5
14	1	2	3	4	5
16	1	2	3	4	5
18	1	2	3	4	5
20	1	2	3	4	5
22	1	2	3	4	5
24	1	2	3	4	5
26	1	2	3	4	5
28	1	2	3	4	5
30	1	2	3	4	5
32	1	2	3	4	5
34	1	2	3	4	5
36	1	2	3	4	5
38	1	2	3	4	5
40	1	2	3	4	5
42	1	2	3	4	5
44	1	2	3	4	5
46	1	2	3	4	5
48	1	2	3	4	5
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52	1	2	3	4	5
54	1	2	3	4	5
56	1	2	3	4	5
58	1	2	3	4	5
60	1	2	3	4	5
62	1	2	3	4	5
64	1	2	3	4	5
66	1	2	3	4	5
68	1	2	3	4	5
70	1	2	3	4	5

ALLRIGHT ANSWER SHEET

NAME _____ STUDENT NUMBER _____

COURSE _____ HOUR _____ TEST NUMBER _____

DATE _____ INSTRUCTOR _____

INSTRUCTIONS: Read each question and then mark, by scratching a "dot" to reveal, the Right (r) or Wrong (w) answer. If an (r) is revealed then proceed to the next question, however, if a (w) is revealed, re-read the question and select another answer. Continue until an (r) is indicated, then go to the next item. When test is completed all items must show an (r).

Q: The capital of Michigan is:
1. Detroit
2. Lansing
3. Flint
4. Ann Arbor

ANSWER: 1 2 3 4 ●

	1	2	3	4
1.	w	r	●	●
2.	●	w	r	w
3.	r	w	w	w
4.	w	w	w	r
5.	●	w	w	r
6.	●	●	●	●
7.	●	●	●	●
8.	●	●	●	●
9.	●	●	●	●
10.	●	●	●	●
11.	●	●	●	●
12.	●	●	●	●
13.	●	●	●	●
14.	●	●	●	●
15.	●	●	●	●
16.	●	●	●	●
17.	●	●	●	●
18.	●	●	●	●
19.	●	●	●	●
20.	●	●	●	●
21.	●	●	●	●
22.	●	●	●	●
23.	●	●	●	●
24.	●	●	●	●
25.	●	●	●	●
26.	●	●	●	●
27.	●	●	●	●
28.	●	●	●	●
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30.	●	●	●	●
31.	●	●	●	●
32.	●	●	●	●
33.	●	●	●	●
34.	●	●	●	●
35.	●	●	●	●
36.	●	●	●	●
37.	●	●	●	●
38.	●	●	●	●
39.	●	●	●	●
40.	●	●	●	●
41.	●	●	●	●
42.	●	●	●	●
43.	●	●	●	●
44.	●	●	●	●
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55.	●	●	●	●
56.	●	●	●	●
57.	●	●	●	●
58.	●	●	●	●
59.	●	●	●	●
60.	●	●	●	●

Form MBM - 7441